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Zwit

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[54] **ELECTRICAL GROUNDING CONNECTOR WITH COMPRESSION CONDUCTOR CONNECTOR**

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[73] Assignee: **Framatome Connectors USA, Inc.**, Fairfield, Conn.

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[51] **Int. Cl.**[6] **H01R 15/00**

[52] **U.S. Cl.** **439/100**

[58] **Field of Search** 24/271, 279, 282; 439/100, 777, 799

[56] **References Cited**

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3,985,411	10/1976	Mooney et al.	339/14
4,189,198	2/1980	Reichman	339/13
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"Electrical Master Catalog, The Electrical Connector Selector", Framatome Connectors International, 1996, pp. D–7, D–10, D–12, N–22 and N–27.

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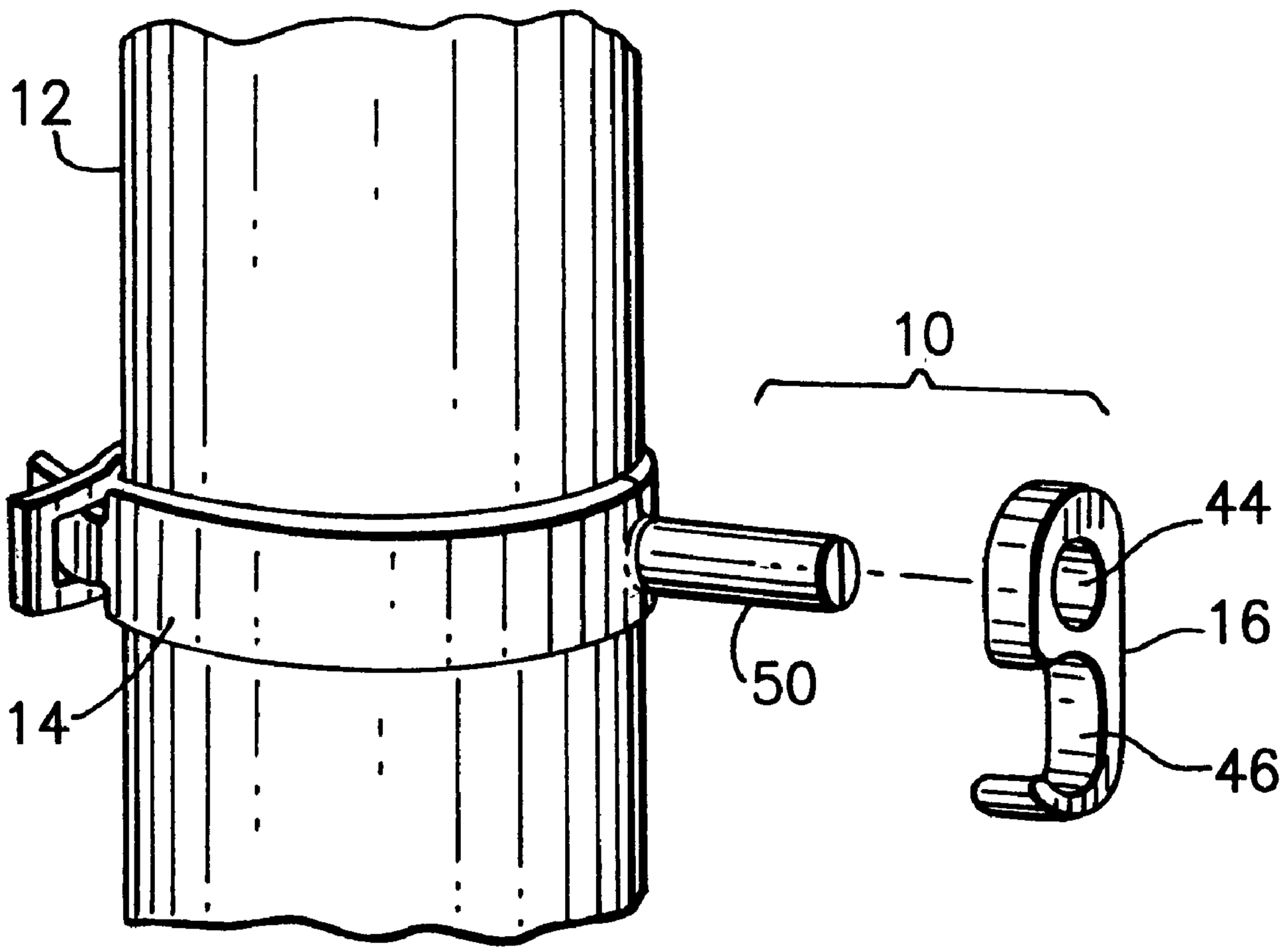
[57] **ABSTRACT**

An electrical grounding connector for connecting a conductor to a pipe. The connector comprises a band and an electrical compression connector. The band wraps around the pipe and has two ends that form an outwardly extending stem. The compression connector has two apertures. The compression connector is mounted to the band with the stem in a first one of the apertures. A conductor is received in the second aperture. The compression connector is compressed onto the stem and the conductor at the same time.

19 Claims, 3 Drawing Sheets



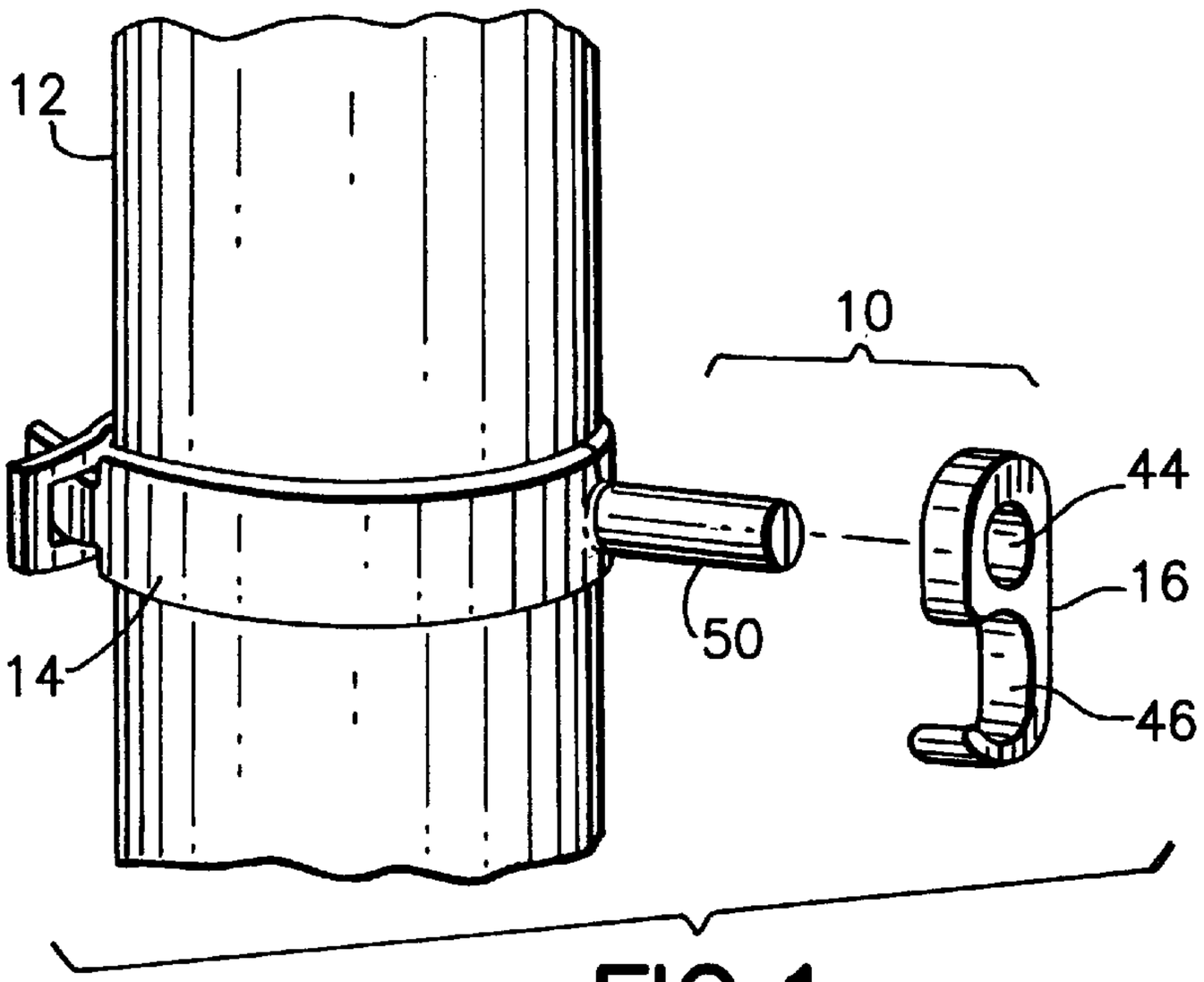


FIG.1

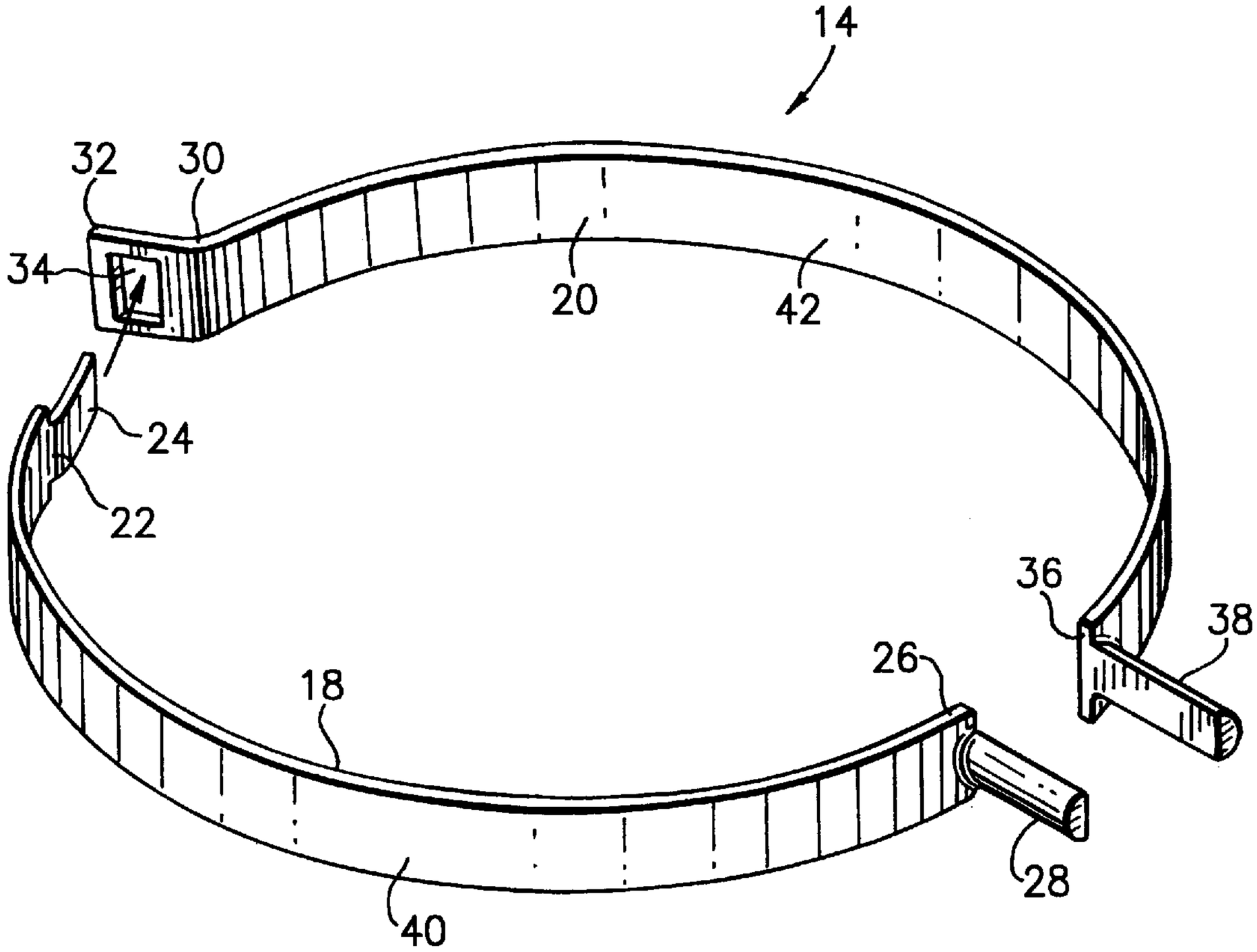


FIG.2

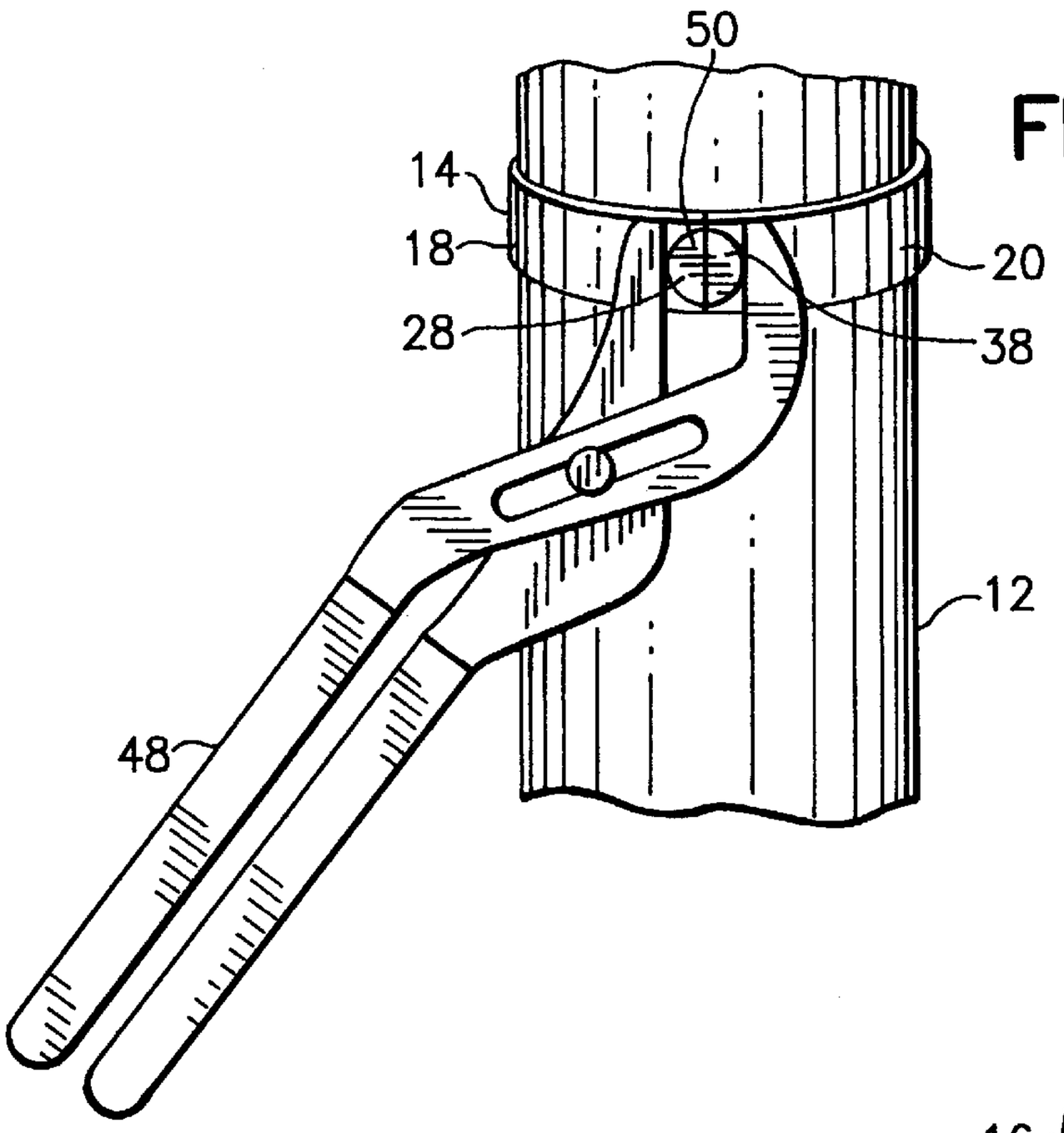


FIG.3

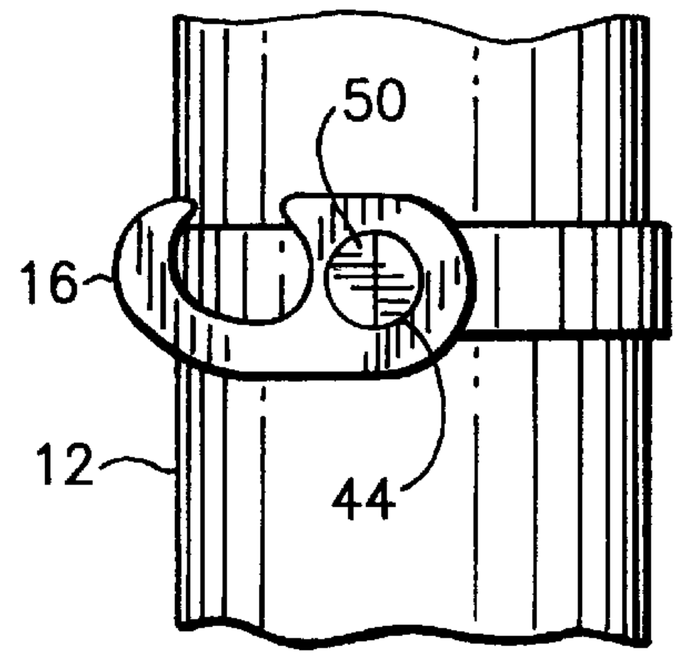


FIG.4

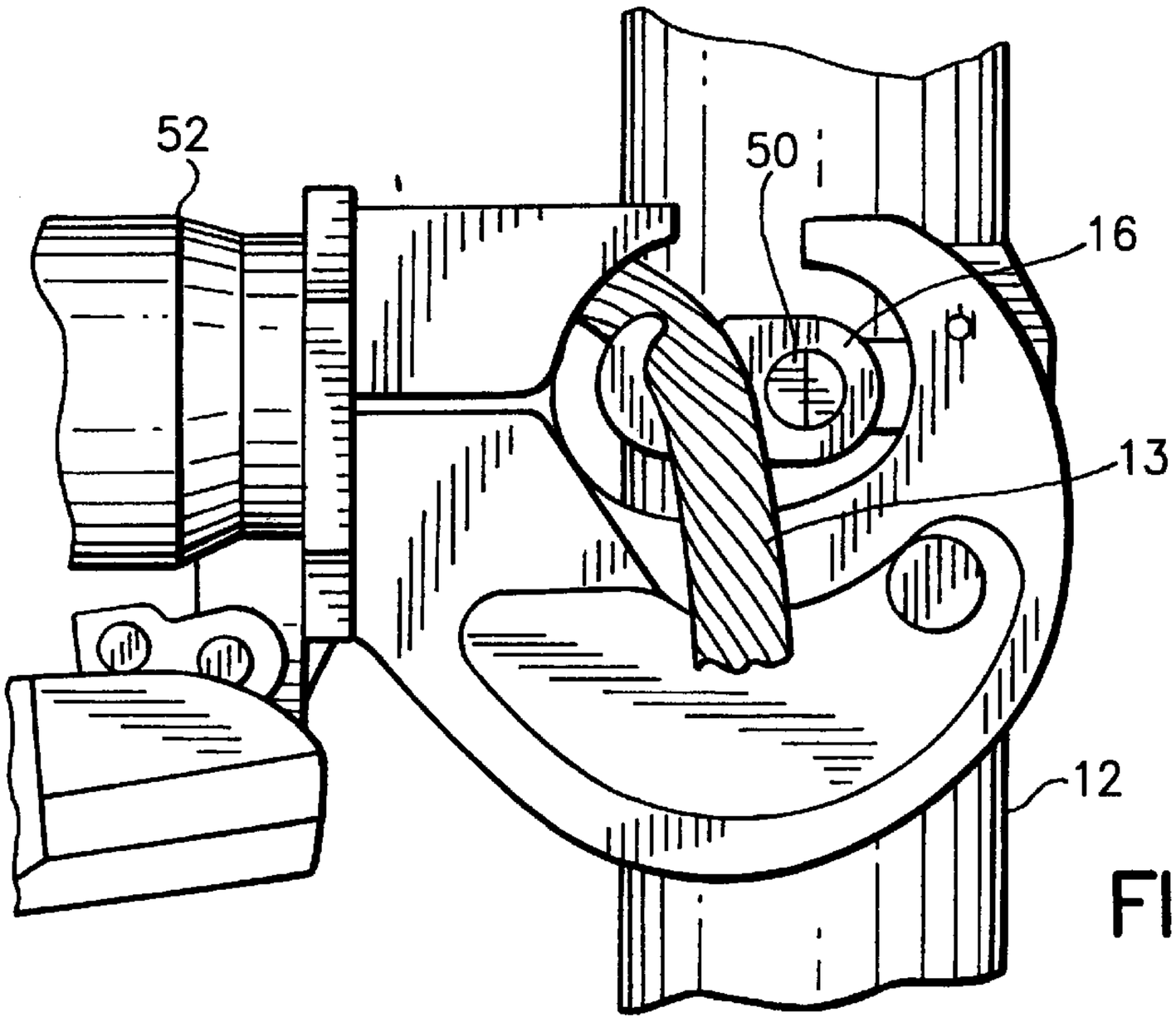


FIG.5

FIG.6

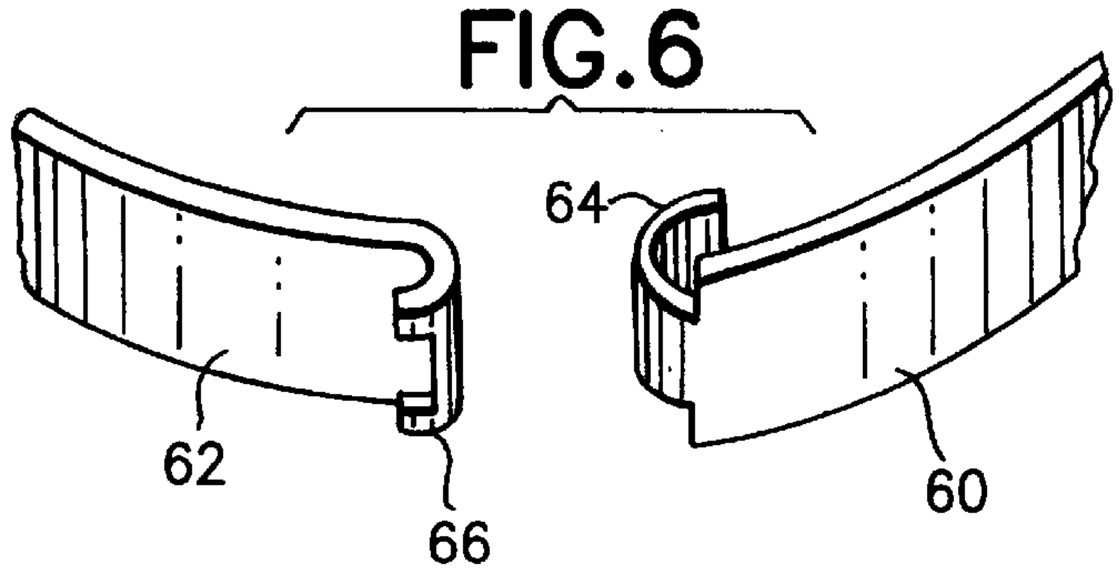


FIG.7

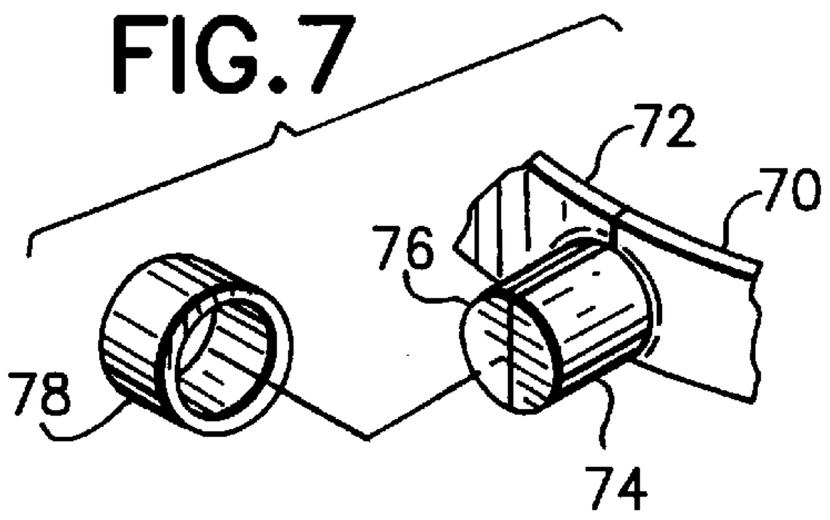


FIG.8

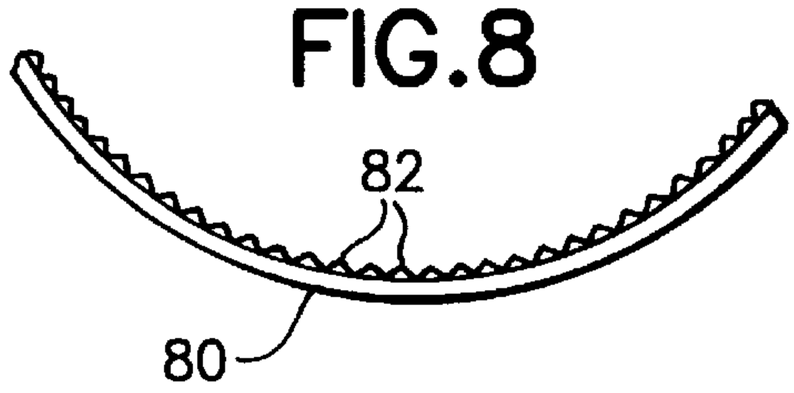


FIG.9

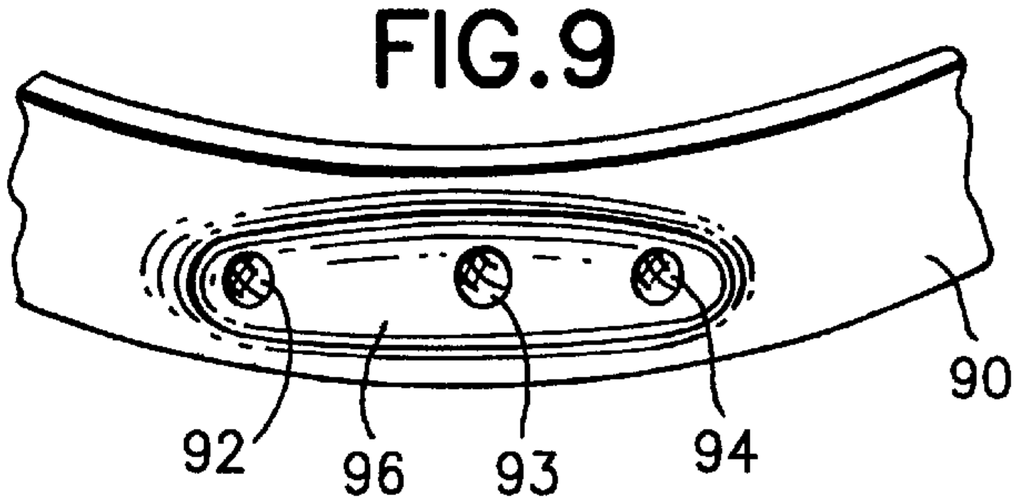
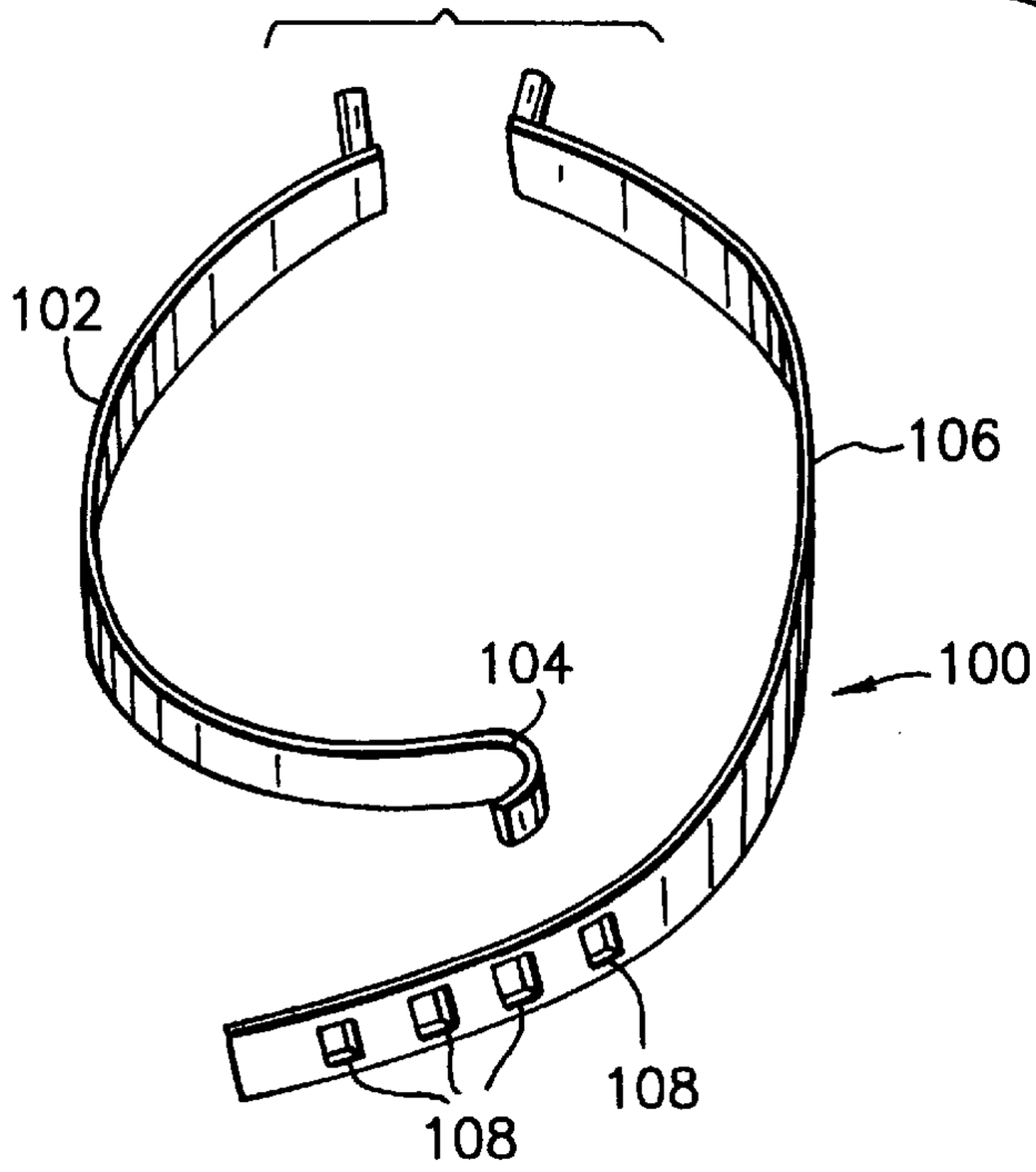


FIG.10



ELECTRICAL GROUNDING CONNECTOR WITH COMPRESSION CONDUCTOR CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to electrical connectors and, more particularly, to a grounding connector with a compression connector.

2. Prior Art

U.S. Pat. No. 4,189,198 discloses a conduit ground wire coupling. The Burndy Electrical division of Framatome Connectors USA Inc. sells compression ground tap connectors known as the type YGHP-C.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, an electrical grounding connector for connecting a conductor to a pipe is provided comprising a band and an electrical compression connector. The band is comprised of electrically conductive material adapted to wrap around the pipe. The band has two end sections that form an outward extending stem for the band. The electrical compression connector has at least two receiving apertures. A first one of the receiving apertures receives the stem therein for connecting the two end sections of the band to each other. A second one of the receiving apertures receives the conductor therein. The compression connector is compressed to fixedly attach the compression connector to the conductor and to the stem at the same time.

In accordance with another embodiment of the present invention, an electrical grounding connector is provided comprising a band and a one-piece electrical compression connector. The band is comprised of electrically conductive material having at least two band sections. The band sections are connectable to each other in series for wrapping around a first electrical conductor. The at least two band sections have mating stem halves that form a compression connector mounting section. The one-piece electrical compression connector is attached to the compression connector mounting section of the band to attach the stem halves to each other. The compression connector has an area for receiving a second electrical conductor. The compression connector can be compression onto the compression connector mounting section and onto the second electrical conductor at the same time.

In accordance with one method of the present invention, a method of attaching a first electrical conductor to a second electrical conductor is provided comprising steps of connecting first ends of two half band strips to each other and placing the strips around the first conductor; placing a one piece electrical compression connector on a stem formed by second ends of the strips; placing the second electrical conductor in a receiving area of the compression connector; and crimping the compression connector onto the stem and onto the second conductor.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and other features of the invention are explained in the following description, taken in connection with the accompanying drawings, wherein:

FIG. **1** is a perspective view of an electrical grounding connector incorporating features of the present invention attached to a pipe;

FIG. **2** is an exploded perspective view of the band used in the connector shown in FIG. **1**;

FIG. **3** is an elevational side view showing the band of FIG. **2** being initially placed on the pipe;

FIG. **4** is an elevational side view of the pipe and band shown in FIG. **3** with the electrical compression connector attached to the stem of the band;

FIG. **5** is an elevational side view of the components shown in FIG. **4** with an electrical conductor located in the compression connector and a hydraulic compression tool being located at the compression connector for compressing the connector onto the electrical conductor and the stem of the band;

FIG. **6** is a partial perspective view of an alternate embodiment of connecting ends of the band sections;

FIG. **7** is a partial perspective exploded view of another alternate embodiment of a connection of the ends of the band strips;

FIG. **8** is a partial top view of an alternate embodiment of the center of a band strip;

FIG. **9** is a partial perspective view of an alternate embodiment of a band strip showing a mounting section; and

FIG. **10** is a perspective view of another alternate embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, there is shown a perspective view of an electrical grounding connector **10** incorporating features of the present invention attached to a pipe **12**.

Although the present invention will be described with reference to the embodiments shown in the drawings, it should be understood that the present invention could be embodied in many different types of alternate embodiments. In addition, any suitable size, shape or type of elements or materials could be used.

The pipe **12** could be an electrical conduit, a water pipe, a gas pipe or any other pipe made of electrically conductive material and connected to ground. The connector **10** is intended to be used to connect a ground conductor **13** (see FIG. **5**) to the pipe **12**. The connector **10** generally comprises a band **14** and a compression connector **16**. Referring also to FIG. **2**, the band **14** is comprised of two half band sections **18**, **20**. Each band section is preferably comprised of electrically conductive material and has a general semi-circular shape. The first band section **18** has a first end **22** with a projection **24** and a second end **26**. The second end **26** has a stem section **28** which is provided as a semi-circular projection. The second band section **20** has a first end **30** with a mounting section **32** having a hole **34**, and a second end **36**. The second end **36** has a stem section **38** which is provided as a semi-circular projection. The projection **24** is sized and shaped to be inserted into the hole **34** and make an interlocking connection of the two first ends **22**, **30** to each other. The two stem sections **28**, **38** are sized and shaped to mate with each other and form a column shaped projection from the band. When the first ends **22**, **30** and second ends **26**, **36** are connected to each other, the center spans **40**, **42** of the two band sections **18**, **20** form a closed ring. The size of the inner diameter or aperture is specifically designed to be the same or slightly smaller than the outer diameter of the pipe **12**. Therefore, when the band **14** is attached around the pipe **12**, it makes a tight mechanical fit therewith as well as an electrical connection. Different size bands would be used for pipes with different outer diameters. In an alternate embodiment, the band could be a one piece member with the

two stem sections **28, 38** on opposite ends. In other alternate embodiments, any suitable type or shape of first end connections could be provided, any suitable type or shape of second end stem sections could be provided, and/or more than two band sections could be used.

The compression connector **16** is a one-piece metal electrical compression connector, such as a BURNDY type YGHP-C or YGHR-C connector. BURNDY is a registered trademark of Framatome Connectors USA Inc. However, in alternate embodiments other suitable types of compression connectors could be used. The connector **16** has two apertures **44, 46**. In this embodiment the first aperture **44** is a closed sided through-hole and the second aperture **46** is an open sided through-hole. The stem halves **28, 38** of the band **14**, when placed against each other, are sized and shaped to be matingly received in the first aperture **44** of the compression connector **16**. The second aperture **46** is sized and shaped to receive an end of the conductor **13** therein. Referring also to FIGS. **3–5**, connection of the conductor **13** to the pipe **12** by the connector **10** will be described. The two first ends **22, 30** of the band halves **18, 20** are connected to each other to form a hinge. The band **14** is then placed around the pipe **12**. A user uses a tool, such as the pliers **48** to compress the two second end stem sections **28, 38** against, or at least closely towards, each other. The two stem sections **28, 38** thus form a single stem **50** onto which the compression connector **16** is mounted. The stem **50** is received in the first aperture **44**. The tool **48** can then be removed since the compression connector **16** will retain the two stem sections **28, 38** together. The compression connector **16** can be moved to its desired final position on the stem **50** and the conductor **13** is inserted in the second aperture **46**. The user then locates a compression tool **52** around the compression connector **16**. The compression tool **52** is preferably a hydraulic compression tool, such as the BURNDY Y35 Hydraulic Crimping Tool, a battery powered tool, such as the BURNDY BCT500, or a power actuated tool that uses a cartridge. However, any suitable compression tool could be used. The user actuates the compression tool **52** to compress or crimp the connector **16** onto both the conductor **13** and the stem **50** at the same time. This forms a permanent mechanical and electrical connection of the conductor **13** to the pipe **12**. Thus, the connection is complete.

Referring now to FIG. **6**, an alternate embodiment of the first ends of the band sections is shown. In this embodiment the two first ends **60, 62** have interlocking curved clasp sections **64, 66**. Referring now to FIG. **7**, another alternate embodiment of the first ends of the band sections is shown. In this embodiment the two first ends **70, 72** have stud sections **74, 76** that are placed against each other. A compression sleeve **78** is then placed on the stud sections **74, 76** and compressed to thereby connect the two first ends **70, 72** to each other. Referring now to FIG. **8**, an alternate embodiment of the center spans of the band sections is shown. In this embodiment the interior side of the center span **80** has barbs **82**. When the band is attached to the pipe, the barbs **82** penetrate through any exterior coating on the pipe to insure a good electrical connection between the pipe and the band. Referring now to FIG. **9**, another alternate embodiment of the center span of one of the band sections is shown. In this embodiment, the center space **90** has threaded holes **92, 93, 94** therein at an additional connector mounting area **96**. With this embodiment, other conductors can be attached to the same band as the conductor **13**. Referring now to FIG. **10**, another alternate embodiment of the band is shown. In this embodiment the band **100** has a first band section **102** with a hook **104** at its first end and a second band section **106** with a plurality of holes **108** in its first end. With this embodiment the two band sections **102, 106** are adjustably connectable to each other to allow the band **100** to be connected to different size pipes. In alternate embodiments, other types of means to provide an adjustable band could be provided.

It should be understood that the foregoing description is only illustrative of the invention. Various alternative and modifications can be devices by those skilled in the art without departing from the invention. Accordingly, the present invention is intended to embrace all such alternative, modifications and variances which fall within the scope of the appended claims.

What is claimed is:

1. An electrical grounding connector for connecting a conductor to a pipe, the connector comprising:

a band comprised of electrically conductive material adapted to wrap around the pipe, the band having two end sections that form an outwardly extending stem for the band; and

an electrical compression connector having at least two receiving apertures, a first one of the receiving apertures receiving the stem therein for connecting the two end sections to each other and a second one of the receiving apertures receiving the conductor therein,

wherein the compression connector is compressed to fixedly attach the compression connector to the conductor and to the stem at the same time.

2. A grounding connector as in claim **1** wherein the band comprises two half band sections connected to each other at first ends, the two end sections that form the stem being located at second opposite ends.

3. A grounding connector as in claim **2** wherein the first ends have sections that interlock with each other.

4. A grounding connector as in claim **2** wherein the first ends are connected to each other by a compression sleeve.

5. A grounding connector as in claim **2** wherein the two second end sections each have a semi-circular cross-section that mate with each other.

6. A grounding connector as in claim **1** wherein the band has barbs to pierce into the pipe.

7. A grounding connector as in claim **1** wherein the compression connector is a one-piece metal member.

8. A grounding connector as in claim **7** wherein the first receiving area is a closed perimeter through hole.

9. A grounding connector as in claim **1** wherein the band includes at least one threaded hole for attaching another connector to the band.

10. An electrical grounding connector comprising:

a band comprised of electrically conductive material having at least two band sections, the band sections being connectable to each other in series for wrapping around a first electrical conductor, the at least two band sections having mating stem half sections that form a compression connector mounting section; and

a one-piece deformable electrical compression connector that is attached to the compression connector mounting section of the band to attach the stem halves to each other, the compression connector having an area for receiving a second electrical conductor,

wherein the compression connector can be compressed onto the compression connector mounting section and onto the second electrical conductor at the same time.

11. A grounding connector as in claim **10** wherein the band sections have first ends that are interlock connected to each other.

12. A grounding connector as in claim **11** wherein the first end of a first one of the band sections is adapted to connect

to the first end of a second one of the band sections at different linear positions along the second band section.

13. A grounding connector as in claim **10** wherein the band sections have first ends that are fixedly connected to each other by a compression sleeve.

14. A grounding connector as in claim **10** wherein the band sections have barbs for piercing into the first electrical conductor.

15. A grounding connector as in claim **10** wherein the band includes at least one threaded hole for attaching another connector to the band.

16. A method of attaching a first electrical conductor to a second electrical conductor, the method comprising steps of:

connecting first ends of two half band strips to each other and placing the strips around the first conductor;

placing a one-piece electrical compression connector on a stem formed by second ends of the strips;

placing the second electrical conductor in a receiving area of the compression connector; and

crimping the compression connector onto the stem and onto the second conductor.

17. A method as in claim **16** wherein the step of connecting comprises interlocking the first ends of the strips to each other.

18. A method as in claim **16** wherein second ends of the strips have stem sections that are placed against each other to form the stem.

19. A method as in claim **16** wherein the step of crimping the compression connector onto the stem and the second conductor occurs at the same time with a single crimp.

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